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Energetics of small, high-temperature laser-driven hohlraums

T. J. Orzechowski, B. Afeyan, R. L. Berger, M. A. Blain†, R. K. Kirkwood, W. L. Kruer, B. J. MacGowan, L. V. Powers, P. S. Springer, M. D. Rosen, J. D. Moody, L. J. Suter,

Lawrence Livermore National Laboratory
P. O. Box 808
Livermore, CA 94550

Hohlraums provide a source of thermal radiation corresponding to temperatures ~100's of eV. This radiation is generated by the interaction of intense laser radiation with the interior of a high-Z (e. g. gold) cavity. The temperature inside the cavity is a function of the laser power and the dimensions of the cavity; higher temperatures correspond to higher laser power and smaller hohlraum dimensions. For a fixed laser power, higher radiation temperatures are achieved with smaller hohlraum dimensions. The radiation in the cavity ablates the hohlraum wall creating a high-Z plasma inside the cavity. Furthermore, the smaller the cavity, the higher the laser intensity on the hohlraum wall (i. e. the laser must be more tightly focused in order to propagate into the smaller cavity). In the conventional "scale-1" Nova hohlraum (L_h=2700 μm, ϕ_h=1600 μm) with the laser focus 1000 μm outside of the laser entrance holes (LEHs), the laser intensity on the hohlraum wall is ~$2x10^{15}$ W/cm^2. In a scale-3/4 hohlraum with laser focus in the LEH the intensity is about $6x10^{15}$ W/cm^2. In the scale-5/8 hohlraum, the intensity on the hohlraum wall approaches 10^{16}W/cm^2. These higher intensities can affect both the x-ray conversion efficiency and the absorbed laser power.

In this paper we report the measured hohlraum temperatures and the inferred absorbed laser power as a function of of the hohlraum size and laser intensity. We compare the measurements with Lasnex and LIP calculations. We also present the results of beam smoothing on the backscattered radiation and the implications for improved hohlraum drive.

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† CEA Limeil-Valenton, Villeneuve-St-Georges, France